

1. NAME OF INITIATIVE: VTD/CKM Lite (Working Title P940)

List of major collaborating institutions (including non-US partners).

A $K^+ \rightarrow \pi^+ \nu \nu$ experiment in an unseparated beam.

Institutions: BNL, Fermilab, IHEP(Protvino), INR(Troitsk), UASLP(Mexico), U. Michigan, U. South Alabama, U. Texas, U. Virginia

2. SCIENTIFIC JUSTIFICATION:

Physics goals. How does it fit into the global physics goals for the entire field.

A measurement of the Branching ratio of the ultra-rare charge kaon decay mode

$K^+ \rightarrow \pi^+ \nu \nu$ with 100 signal events and less than 10% background to yield a measurement of $|V_{td}|$ with 6% experimental and 8% theoretical uncertainties.

The measurement of this branching ratio is identified as the cleanest way to measure the magnitude of the CKM matrix element V_{td} which controls CP violation in the Standard Model. It is one of only 3-4 theoretically robust observables presently accessible, which together, could falsify the Standard Model description of CP violation thereby demonstrating the existence of physics beyond the Standard Model at the scale of the electro-weak loop diagrams probed by these K and B decays.

In addition to this primary physics goal there are a broad set measurements and rare decay searches in both charged kaon and pion decays.

3. VALIDATIONS FOR SCIENTIFIC JUSTIFICATION:

Examples of recommendations and supporting statements from the committees, panels, and the community at large.

The same physics goals, implemented with a separated beam technique as CKM, were reviewed and awarded scientific approval by the Fermilab Program Advisory Committee and the Fermilab Director. CKM was evaluated by P5 as:

The sub-panel was impressed with the excellent work of the proponents of the design of the experiment and their successful prototyping results. CKM is an excellent work class experiment, which would be able to produced world class physics results.

The change to an unseparated beam adds an additional physics program of precision measurements and rare decay searches in charge pion decay to the original CKM physics program in charged kaon decays.

4. DESIRED SCHEDULE:

List major milestones (month & year) such as design complete, construction start, construction complete, etc.

To be timely with measurements of the other presently accessible robust observables. These include the measurement of the $K^0 \rightarrow \pi^0 \nu \nu$ branching ratio by the KOPIO experiment at Brookhaven which is now funded and planning to begin data taking in 2009-10 and the potential measurement of mixing in the B_s system by the Run II detectors at Fermilab by 2009.

A competitive experiment to make this measurement is now being proposed at CERN (NA48/3) with a planned completion of 2009.

5. ROUGH ESTIMATE OF COST RANGES:

Whatever the best information available (eg. \$M +/-30~50%, \$150~250M, etc.). Total cost range including non-DOE funding (if any other funding sources are assumed and if known, state from where and how much. Also indicate remaining R&D cost to go.

Significantly less than 50M\$ TPC including all labor, overhead, contingency, etc.

6. DESIRED NEAR TERM R&D:

Major activities needed to be completed before start construction.

Evaluation of the MicroMegas beam chamber technology developed for NA48/2 at CERN by the Saclay group. This is the important technical change from the design of CKM. The separated K^+ beam is substituted by a high rate beam tracking system (230 MHz) to allow the replacement of the separated K^+ beam with the existing KTeV beamline converted from a neutral to a charged beam (as was done in the NA48 -> NA48/2 transition at CERN). All other beam and detector technologies are adaptations from the proven designs developed for CKM and KTeV

7. BRIEF DESCRIPTION OF LABORATORY'S ANTICIPATED ROLE:

Expected unique capabilities to be provided by lab. Rough estimate of human resources from lab (#FTE in what type labor).

- Provide 120 GeV Main Injector slow spill protons with at intensities of 5×10^{12} /spill (15% of initial Main Injector design intensity).
- Host the experiment in the NM2-3 beamline (existing KTeV beamline and Hall).